



Policy making in China's space program: A history and analysis of the *Chang'e* lunar orbiter project

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ABSTRACT

China's space program is one of the most advanced, rapidly improving and opaque in the world. Insight into the program's policy-making process could help eliminate misunderstandings, make intentions more clear and promote stability in US–China relations. This case study of China's first lunar orbiting probe traces the project from initial policy proposal through agenda-setting, policy approval and final policy implementation. It reveals a highly rational decision-making process that is ruled by incrementalism, consensus building, scientific judgment and the use of leading small groups to coordinate among ministries. This research was guided by several relevant theories, including the “fragmented authoritarian” framework of power, the theory of the “policy entrepreneur” and the recently developed “inside access model”. The paper is one of the first published accounts in the English language to detail, from policy proposal to policy implementation, China's first mission to the Moon.

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China's space program is one of the most advanced, rapidly expanding and opaque in the world. The mystery surrounding it heightens fears and fuels speculation. Much of our knowledge of the space program is revealed only in highly publicized glimpses, such as when the nation achieves noble triumphs like placing a human into orbit or successfully orbiting the Moon. Military observers tend to focus on the less public accomplishments of China's rocket program, like the recent ballistic missile intercept test and the 2007 anti-satellite missile test. Much of the national space program, a vast conglomeration of military and civilian organizations, is kept intentionally opaque. However, in recent years information on certain projects of limited military utility has been released to the public. The first lunar orbiter mission, *Chang'e 1*, falls into this category of project. It is unique in this respect because, while it was a project of national prestige that involved coordination at the highest levels of government, military and Party, there is also an abundance of information available on its development. Insight into this policy-making process could provide much-needed transparency into the decision making that guides the world's newest scientific and technological superpower.

China's space program provides several key benefits to the nation. First, it expands the high-technology sector and helps to integrate key military and technology industries. The joint development of “dual-use” technologies is an increasingly important goal as China seeks to make state defense industries more efficient, while developing indigenous technological capabilities. Second, the

space program is an important driver of science and technology innovation in business and of technical education in schools. Third, the space program is a universally recognized symbol of national prestige. In China it is the crown jewel of a burgeoning technology and industrial empire. Fourth, the program is a useful propaganda tool for the ruling Party. Major missions stoke nationalism and provide popular legitimacy.

The national lunar program consists of three major project phases: the successful launch and orbit of a spacecraft to map the Moon's surface, landing an unmanned lunar rover on the Moon, and a lunar sample return mission to carry lunar material back to Earth. The first phase and the subject of this case study, *Chang'e-1*, was successfully completed in March 2009.¹ Chinese space officials recently announced that there are studying the possibility of a manned Moon mission around 2025.

This article seeks to explain decision making in the Chinese space program bureaucracy. Focusing on Lieberthal and Oksenberg's insight that the nature of the Chinese political system is “fragmented authoritarian”, the specific strategies used by policy entrepreneurs to propose policy, set the agenda and implement policy will be explored. Additional theories of policy-making will also be considered in order to develop a model of policy-making in China's lunar space program.

¹ A near-duplicate of the *Chang'e 1* orbiter, known as *Chang'e 2*, is slated to launch in 2010–11. This mission will feature enhanced instruments and will mark the actual conclusion of the first phase of the lunar program.

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2. Theories of policy making

“Fragmented authoritarianism” continues to be the most robust framework available to understand China’s political system. The term was first coined by Kenneth Lieberthal and Michel Oksenberg to characterize Chinese policy-making in the modern reform era. The system it describes is authoritarian in the discipline it exerts over subordinates, and relatively closed to public policy input from citizens; it is fragmented in that territorial and functional lines of authority below the center are often disjointed and policy making incremental.² Decision making is characterized by inter-bureaucracy negotiations, bargaining and consensus building. The fragmented authoritarian framework is institutionalist and pluralist in that bureaucratic structure itself helps to guide policy decisions, but factions may compete for influence.

The process is protracted, with most policies shaped over a long period and acquiring a considerable history that is well known to many of the participants; it is disjointed, with key decisions made in a number of different and only loosely coordinated agencies and inter-agency decision bodies; and, it is incremental, with policy in reality usually changing gradually.³

During the initial policy proposal stage, John Kingdon’s theory of “policy entrepreneurs” is particularly useful. He defined policy entrepreneurs as “advocates for proposals or for the prominence of an idea”. They are defined by “their willingness to invest their resources – time, energy, reputation, and sometimes money – in the hope of a future return... in the form of policies of which they approve.”⁴ This theory seeks to account for policy proposals offered by citizens not firmly situated in the ranks of power. Elite scientists, for example, do not necessarily have the political power to make policy decisions yet they may propose major policies.

The method by which their policies are placed on the agenda is detailed by Wang Shaoguang’s “inside access model”, which accurately describes the policy subsystem involving policy entrepreneurs. Policy solutions are proposed by advisors and members of the scientific elite within government. These advisors do not necessarily seek public approval, and interaction is primarily between policy advisors and policy makers.⁵ This model is premised on the notion

that China has a closed authoritarian political system, and most decisions are made within government with little or no input from citizen groups.

Policy making in the lunar program is remarkably similar to other areas of policy making in China, with the major caveat that the program frequently does not consider any input from citizens or the media and most decisions are made behind closed doors.⁶ This case study utilizes original Chinese source material and interviews to explore the actual processes and methods utilized to propose policies, set agendas and implement policy.⁷ There are several key strategies for proposing policy ideas, setting agendas, making policy and implementing policy in the Chinese political system:

- advocacy groups of elite policy entrepreneurs (e.g. Chinese Academy of Sciences scientists);
- *Guanxi* (interpersonal relationship networks);
- the use of Leading Small Groups (*lingdao xiaozu* – LSGs) to coordinate various organizations.

3. New policy idea

The idea of a Chinese voyage to the Moon is as old as the ancient story of the Moon goddess *Chang’e*, who is said to have floated away to the celestial body after an argument with her lover. Contemporary policy proposals for a lunar program have existed since the 1960s, and they gained renewed traction in the late 1980s, after Deng Xiaoping introduced the multi-billion dollar “863” high-technology funding program.⁸ This program would provide seed money to thousands of projects that would provide the technology and industrial foundation for China’s current growth.

The genesis of the policy proposal that would later become the successful *Chang’e-1* lunar probe project can be found in a confluence of events in the early 1990s. The Chinese human spaceflight program, a product of the “863” plan, would begin operations in 1992 after years of planning and development.⁹ Also, the launch of the Japanese lunar probe *Hiten* in 1990 had a catalyzing effect on space scientists in China. One of the most outspoken of these scientists was Ouyang Ziyuan, who in 1990 was a prominent geologist in Guizhou province with a deep knowledge of lunar geology. A year later, he would transfer to the most prestigious academic institution in China, the Chinese Academy of Sciences (CAS) in Beijing. He assumed the leadership of the Institute for Geochemistry and quickly set out to engage the scientific community in a new policy idea: the first-ever Chinese mission to the Moon.

Scientists at the Chinese Academy of Sciences occupy a special position within the government and scientific community. They are regarded as the nation’s pre-eminent scientists and are highly respected in society.¹⁰ While political elites may desire CAS scientists to be both “red and expert”, party membership is not a prerequisite for entry into CAS.¹¹ However, top scientists are regularly offered membership in the Chinese Communist Party (CPC), and those with particular influence may be awarded seats in the National People’s Congress, Chinese People’s Political Consultative Conference and CPC Central Committee.¹²

² Kenneth Lieberthal, *Governing China: From Revolution through Reform* 2nd ed. (W.W. Norton & Co., 2002).

³ Ibid.

⁴ John W. Kingdon, *Agendas, Alternatives, and Public Policies*, 2nd ed. (New York: HarperCollins, 1995), pp. 122–23.

⁵ Shaoguang Wang, “Changing Models of China’s Policy Agenda Setting,” *Modern China* 34, no. 1 (2004).

⁶ Recent news reports suggest this may be changing for the second phase of the *Chang’e* program, which will place a robotic lander on the lunar surface. The State Administration for Science and Technology Industry for National Defense (SASTIND, the successor to COSTIND – see below in text) has reported that dozens of universities are competing to develop key parts of the lander.

⁷ Note on source – Information about the Chinese space program is very closely monitored and carefully scrubbed by authorities. However, there are pockets of reliable information on the first phase of the lunar program available in the published and open-source literature. Much of the first phase of the program (*Chang’e 1*) has been completed and is no longer operational, as the orbiter crashed into the moon in March 2009. The first drafts of history have recently been published and program scientists and officials can more freely discuss project details (and embellish their historical roles), providing useful primary source information. Nearly all information on the program is written in Chinese. This study relied extensively on official Chinese government sources, including documents published by the State Council Information Office and state-owned science and technology, and defense industry publishing houses. Additionally, newspaper reports from the *People’s Daily* and *Xinhua* were utilized. Books written by members of the lunar team (such as Ouyang Ziyuan) and outside journalists illuminated the social and political context of decision-making. Finally, personal interviews with China space program officials supported and verified published accounts.

⁸ “863” refers to the date of its inception: March 1986.

⁹ The human spaceflight program is known as codename Project 921 or China Manned Space Engineering.

¹⁰ Cao Cong, *China’s Scientific Elite* (London: Routledge Curzon, 2004).

¹¹ Ibid.

¹² Examples of space scientists who also hold high political office include Qi Faren, Chief Designer of Shenzhou 1–4 (CPPCC) and Luan Enjie, General Commander of Lunar Mission (CPC Central Committee).

After the reform and opening up period, the concept of “scientific decision making” became paramount and signaled a new reliance upon think-tanks and educated advisors.¹³ The elite scientists at institutions such as the CAS can be influential policy advisors.¹⁴ Similarly, Hu Jintao’s “theory of scientific development” champions the utility of science to solve the nation’s most pressing social and economic problems. As the scholars Zhao Quansheng and Cao Cong have noted, think tanks and academies are assuming powerful roles as advisors to top policy makers.¹⁵

Occasionally, CAS scientists are also policy entrepreneurs. For example, the State High Technology Research and Development Program (commonly known as the “863” program) was implemented in 1986 as a way for China to quickly and broadly accelerate its science and technology activities. The program provided billions of dollars to the military, government ministries and academic institutions for new projects, including space. The program itself was advocated and intensively pushed by a small group of like-minded scientists in the early 1980s. Wang Daheng, Wang Gan-chang, Yang Jiachi and Chen Fanyun were influential pioneers in China’s nuclear weapons program. They drafted a short letter to paramount leader Deng Xiaoping, suggesting that China must develop a science and technology program to develop indigenous capabilities. The proposal was partially in response to the recently announced US Strategic Defense Initiative. The scientists sought out personal connections close to Deng, and effectively jumped several levels of the bureaucracy to have their letter heard. They were successful and the “863” program was launched.¹⁶

Similarly, the decision to create the *Beidou*, or “Compass” national satellite navigation system resulted from the efforts of a core group of dedicated scientists tirelessly pushing their policy proposal upon decision makers.¹⁷ Further study is required before a definitive model of this type of policy advocacy can be formulated, but in addition to “863” and *Beidou*, this study suggests that the *Chang’e-1* lunar project is another example of this type of policy advocacy.

When Ouyang Ziyuan first floated the idea of a lunar exploration program, he drew criticism from some fellow scholars. His idea was primarily driven by political motivations, because he suggested that the handover of Hong Kong to China in 1997 should coincide with the launching of a rocket to the moon. The boost to patriotism and nationalist sentiment would be tremendous, he argued. His proposal caught the attention of many scientists at CAS, including high-ranking Academician Min Guirong. With a small group of supporters, he convinced the central government to consider the proposal, but it was swiftly rejected on the grounds that it was primarily politically motivated and lacked solid scientific value.¹⁸

In the Mao era numerous national defense programs were developed to address key military and strategic issues, in addition to serving political goals. One of the most famous is the “Two Bombs, One Satellite” (*liang dan, yi xing*) program. Mao Zedong sought to develop an atomic bomb, a hydrogen bomb and to launch

a satellite as part of a massive national security push with broadly distributed social and economic development benefits. The program was inspired and quickly co-opted by members of the ideological and political elite, who proclaimed that the nation’s science and technology industries would be revamped and a new communist-patriot spirit would pervade all work. Mao’s intense political motivation and ideological excesses had a seriously detrimental effect on S&T development and nearly derailed the nascent rocket and space program.¹⁹

Academician Min Guirong, the director of an “863”-sponsored group on aerospace at CAS and a supporter of the lunar program, suggested the formation of a task force for a lunar mission. The task force would bring like-minded scientists and policy entrepreneurs from CAS together. Most importantly, Ouyang Ziyuan and the team could receive initial funding from the “863” program to continue working on their draft report. For Ouyang Ziyuan, it now became clear that China had the money and it nearly had the technology for lunar exploration.²⁰

In 1993, the newly created China National Space Administration (NSA), led by Administrator Liu Jiyuan and Deputy Administrator Luan Enjie, conducted a feasibility study that suggested the Long March 3A rocket could reach the moon and deliver a satellite into orbit. The study was presented to central government policy makers, who again concluded that there were no sound scientific objectives and the excessive costs did not warrant a mission.²¹ According to key scientists, the CNSA effort was independent of the CAS effort.²²

The CAS scientists would later recall that they were beginning to worry whether the project would ever be successful. After the successful launch of NASA’s *Clementine* lunar probe in 1994, Ouyang Ziyuan lamented that, in the face of global competition, if China were indifferent, the country would fall behind internationally and lose its voice.²³ He was not alone, as key advocates have also defined the program as needing to keep pace with the international community of lunar exploration.²⁴ Since the beginning a key rationale of the program was to maintain China’s international competitiveness and to match the contemporary Japanese and US lunar efforts.

In 1995 the “863”-funded lunar task force led by Min Guirong at CAS finally finished its report, “The Necessity and Feasibility of China’s Lunar Exploration Program”. Ouyang Ziyuan and Chu Guibo were the principal authors.²⁵ The report was circulated among colleagues, rather than higher-level decision makers. A wildly optimistic and controversial feature of the report was the prediction that the moon was a likely source of the element Helium-3 (theoretically, an ideal element for nuclear fusion) and could one

¹⁹ The story of Qian Xuesen, a pioneer of China’s space program, is particularly noteworthy. As biographer Iris Chang recounted in *Thread of The Silkworm* (1996), upon his expulsion from the USA and return to China, he adopted the Communist ideology and became a senior science advisor to Mao on a broad array of policies. Noting the tremendous harm done by unscientific or ill-advised science policies during the Great Leap Forward, it would appear that commitment to ideology often trumped sound scientific rationale.

²⁰ Yang Zheng, “Xin You Yue Hui Zhao Zhao Yao Tu,” in *Jing ji ri bao* (Economic Daily) (2009).

²¹ Shao Gai He, “Chang’e Benyue Zhilu (The Path of Chang’e to the Moon),” *Guofang Keji Gongye*, (National Defense Science & Technology Industry) (2007) pp. 76–81.

²² Yang Zheng, “Xin You Yue Hui Zhao Zhao Yao Tu,” *Jing ji ri bao* (Economic Daily) (2009).

²³ Translated from Chinese by author. This is also commonly referred to as ‘losing one’s seat at the table’, or “yi xi zhi di (a place for one’s mat)” Source: <http://www.amacad.org/publications/spaceChina.aspx>.

²⁴ People’s Daily, “Why Does China Start a Lunar Exploration Program?,” in *The People’s Daily* (2003).

²⁵ Ouyang Ziyuan and Chu Guibo, “Wo guo kaizhan yueqiu tance de biyaoxing yu kexingxing (Necessity and Feasibility of Developing a Chinese Lunar Probe)” (1994).

¹³ See for example Xinhua, “Zhongnanhai Qingting Kexue Sixiangku Jingyan (Chinese Leaders Listen to a Scientific Think Tank,” in *Xinhuanet.com* (November 9, 2004).

¹⁴ Science, “Science Interview: China’s Leader Commits to Basic Research, Global Science,” in *Science* (2000), Jiang Zemin, “Science in China,” in *Science* (2000).

¹⁵ The Chinese Academy of Social Sciences is just one example. Zhao Quansheng has written extensively on the role of think-tanks in formulating Chinese foreign policy.

¹⁶ Gregory Kulacki, and Lewis, Jeffrey G., “A Place for One’s Mat: China’s Space Program, 1956–2003,” (American Academy of Arts and Sciences, 2009).

¹⁷ Interview with Chinese space official 1.

¹⁸ Shao Gai He, “Chang’e Benyue Zhilu (The Path of Chang’e to the Moon),” in *Guofang Keji Gongye* (National Defense Science & Technology Industry) (2007).

day support China's energy needs. The report is generally acknowledged to be the first formal investigation of a potential lunar mission by official CAS experts.²⁶

The strategy of linking up interested scientists and policy advocates was paying off. Nevertheless, the coalition was largely academic and lacked prominent support from the central government and even initial support from the military or the Party. Given the type of project proposed – an expensive, high-profile scientific lunar mission to be launched on military rockets – high levels of support from all three would be necessary to achieve policy approval.

In 1995, the rocket development group at CASC announced that a new *Long March 2F* rocket would loft the first *Shenzhou-1* capsule into orbit in 1997, heralding the beginning of the manned space program. The group suggested that the LM-2F could be used for lunar exploration, specifically, as a way to welcome the return of Hong Kong in 1997. This plan was also dismissed. According to the official journal of the national defense industry, clear-cut scientific objectives or an engineering plan had still not materialized.²⁷ Proposals for a lunar mission had been offered by CAS academics, CNSA, and a key institute of the military–industrial complex. None was successful and all were cited for a lack of specificity, scientific rigor and/or a satisfactory engineering plan.

The CAS group led by Min Guirong and Ouyang Ziyuan was composed of “policy entrepreneurs”, or a group of advocates that pushed for a specific policy proposal. In Kingdon's formulation, small groups of elites may initiate and develop policy initiatives. The scientists held a curious position as government officials, but not government policy makers, which placed them in the position of acting as both advisors and advocates for a specific space policy.

4. Setting the agenda

While Ouyang Ziyuan, Min Guirong and other colleagues at the CAS were influential in their academic fields and in some political circles, their policy proposals were met with silence or dismissed by policy makers, who insisted upon having a clear scientific rationale for any lunar mission. Similarly, Luan Enjie of CNSA was an early supporter of the lunar exploration program and provided early engineering studies to strengthen the case for a lunar program. But, in his position at CNSA (a small inter-agency organization primarily tasked with coordinating space cooperation among various organizations domestic and international), he was too far from the levers of power to effect change.

While the CAS group and Luan Enjie worked toward a common goal, there is no evidence that they worked closely together to develop proposals; indeed, the opposite appears to be the case. Ouyang recalled in a later interview that he, Luan Enjie and Sun Jiadong (Chief Designer) would really only know each other after the lunar program was approved.²⁸ Without high-level support or a coordinated effort between the various policy advocates, the multiple lunar program proposals could not gain traction. This distribution of power and stove-piping in the government is a key feature of “fragmented authoritarianism”. Multiple institutions may push similar policy proposals unknown to each other. Only at the highest levels of decision making can these parallel efforts be detected. These high-level organs include the National Development and Reform Commission (NDRC), which often provides initial

approval or the State Council, which approves nearly all projects before submission to the National People's Congress.

A crucial breakthrough came in 1998, when the State Council reorganized the Commission for Science and Technology Industry for National Defense (COSTIND).²⁹ Founded in 1982, it had Ministry-level authority and reported directly to the State Council. It originally had a large portfolio that included defense industry procurement, development and production. Subsequent reforms weakened the institution, and in 1998, it was civilianized and military work was shifted to the General Armaments Department of the PLA. In its new role, the organization would provide independent oversight of the development of defense products, promote efficiency through civil–military integration and eliminate corruption. In its role as the key institution responsible for civil–military integration, it occupied a unique position straddling the government/military divide. The military functions very much like a “state within the state” and its leading body, the Central Military Commission, has equivalent authority to the government's State Council.³⁰ Thus, coordination between military and government can be difficult, and COSTIND was created and re-organization in part to facilitate coordination. The CNSA was placed under COSTIND administration. Luan Enjie was promoted from his position as Deputy Administrator of CNSA to Administrator of CNSA and also Deputy Director of the superior COSTIND. He wielded his power quickly and the organization immediately set about developing a long-term space program that would include a lunar exploration project.

By early 2000, the CAS lunar team had broadened its effort and now consisted of representatives from other CAS centers such as the National Observatories of China, the Center for Space Science and Applied Research, Xi'an Institute of Optics and Precision Mechanics and the Shanghai Astronomical Observatory. In 2000, they submitted a final report, titled “The Scientific Objectives of a Chinese Lunar Resources Orbiter”.³¹ This was their ultimate response to official requests to explain the lunar program's scientific rationale. The report highlighted several important points. First, it suggested that China should seek to discover and recover Helium-3 on the Moon. Such an element has been theorized to be an ideal starter fuel for fusion. Second, the report proposed that China embark on a “three phase” lunar program to include a probe, a lunar rover and a lunar sample return mission.³²

Important pieces of the puzzle were now addressed. In Luan Enjie, a strong supporter of the project had ascended to a government position with influential power. Using his “inside access” and interpersonal connections, he was able to advocate the policy to top policy makers and contributed to its placement on the agenda. As Wang Shaoguang noted in his “inside access model”, this method of agenda-setting typically occurs when the policy initiators are advisors to those in power (as opposed to decision makers or ordinary citizens) and when the degree of public participation is low. A high-level government insider is able to utilize both the power of his office and personal connections to push a policy onto

²⁹ According to Chinese law, the leader of COSTIND is chosen by the Standing Committee of the National People's Congress and confirmed by the President. COSTIND was known by the full Chinese name Guofang Kexue Jishu Gongye Weiyuanhui, or its shortened form Guofang Kegong Wei, which is often used in documents.

³⁰ Government and military are reconciled at the apex, by the Party General Secretary (currently President Hu Jintao).

³¹ “Wo guo yueqiu ziyuan tance weixing kexue mubiao”. Cited in Shao Gai He, “Chang'e Benyue Zhilu (Chang'e Lunar Exploration Road)”, in Guofang Keji Gongye (National Defense Science & Technology Industry) (2007).

³² This three-phase plan was adopted and is popularly known as “Rao, La, Hui (Orbit, Land, Return).

²⁶ He, “Chang'e Benyue Zhilu (The Path of Chang'e to the Moon).”

²⁷ Ibid.

²⁸ Yang Zheng, “Xin You Yue Hui Zhao Zhao Yao Tu,” *Jing ji ri bao (Economic Daily)* (2009).

the agenda. However, simply getting an item on the agenda is no guarantee of success. In policy making, the jump from an agenda item for discussion to an action item for implementation can be fraught with obstacles.

In the context of the Chinese lunar program, these obstacles included the approval of scientific studies and engineering plans, as well as intense bureaucratic negotiations over funding. In late 2000, the scientific rationale for the mission won approval from central government policy makers in the former State Planning Commission and the State Council. This approval was sufficient to get initial project funding for further studies. Full funding would be approved after the State Council and the military reviewed the final feasibility study and engineering plan. Additionally, the fragmented authoritarian framework suggests that a complex process of negotiating, bargaining and consensus building would occur before final funding approval.

5. Funding the project

In November 2000, the State Council published the *White Paper on China's Space Activities*, a policy outline which included lunar exploration as part of the country's national development plan.³³ The White Paper indicated that a pre-study for a lunar project had been approved. Planning for the mission would continue along two main lines, focusing on the scientific and engineering plans. Luan Enjie continued to serve as an influential policy advocate for the project.

In January 2001, COSTIND held a conference in the frigid northern capital of Harbin to discuss the way forward, focusing on the various engineering aspects associated with lunar exploration. Shortly thereafter, CAS held its own conference to discuss the science behind lunar exploration. In late 2001, Sun Jiadong, an eminent aerospace engineer and member of the Chinese Academy of Engineering, was designated as the new Chief Designer and began developing an engineering work plan.

In October 2002, Premier Zhu Rongji was briefed on the progress of lunar exploration program studies and he expressed his support for continuing work on the feasibility reports. A month later, Sun Jiadong organized COSTIND, the CAS, the General Armaments Department of the PLA, China Aerospace Science and Technology Corporation and over 200 scientists from universities around the country to begin the final demonstration phase of the project. Three months later, in March 2003, the project published its final report, "Feasibility Report on the First Phase of the Lunar Orbiter Project",³⁴ along with seven other related feasibility studies. This marked a significant step in the policy-approval process, and was a key requirement of the National Development and Reform Commission, State Council and military. The final engineering plan would be completed shortly thereafter.

Such feasibility studies are an essential part of policy making in the space program, and in policy-making in general. Major state project proposals in China are usually forwarded by ministries (such as COSTIND) to the National Development and Reform Commission (NDRC, previously the State Planning Commission, which controlled the centrally planned economy). The NDRC requires feasibility studies for major projects, and it can either

accept the work done by the ministry or insist upon an independent feasibility study.³⁵ The back-and-forth over the feasibility study between ministry and NDRC illuminates the process of consensus building essential to the fragmented authoritarianism of the political system. Major players contribute to the feasibility study, as a way to submit inputs, voice opinions and protect departmental resources. The NDRC may also reject the study and request resubmission, as happened several times previously with lunar probe studies.

The NDRC considers a long list of project proposals from various ministries and then approves them before sending to the State Council for inclusion in the Five-Year Plan. The Five-Year Plan outlines the nation's primary development goals from one major meeting of the Communist Party of China Central Committee meeting to the next. The State Council is usually the final arbiter of which projects will be included in the Five-Year Plan, which is ultimately ratified by the National People's Congress. Projects of sufficient scale and expense may also require review by the Ministry of Finance. Approval for some projects is made at the State Council level and even higher in certain leadership groups associated with the Central Committee.³⁶

In January 2004 Premier Wen Jiabao and other members of the Party Central Committee approved the general plan to conduct long-term lunar exploration in three phases (orbit, land, return), and formally approved the budget for phase one.³⁷ The lunar orbiter project was given a name, *Chang'e 1*, which recalled the ancient Chinese Moon goddess myth. The Committee also approved four scientific objectives and five engineering objectives for the mission.³⁸ It seems likely that this elevated decision making was the result of the huge number of ministries and organizations involved in the activity, rather than the cost of the project, which was relatively modest for a major project (reportedly about US\$190 million). The process whereby specific funding is granted is still highly opaque, and is probably dependent upon the complex social, political and economic environments in which the decision is made. Interestingly, funding for the project was reportedly increased after President Hu reviewed it and insisted a second back-up orbiter be manufactured, as a precaution against failure.³⁹

6. Policy implementation and leading small groups

In order to implement policy across the various stove-piped ministries in China, a high-level coordinating body is necessary. In the case of the lunar project, both civilian and military ministries would need to work together, necessitating the need for a leading small group (*lingdao xiaozu* – LSG) of substantial authority.

In China, there are a variety of LSGs that coordinate government policy on influential issues. Examples of leading small groups include the Foreign Affairs, Finance and Economic Affairs, Agricultural Affairs,

³³ Kenneth Lieberthal, and Michel Oksenberg, *Policy-Making in China: Leaders, Structures and Processes* (Princeton: Princeton University Press, 1988).

³⁷ Xinhua News, "Wo guo raoyue tance gongcheng dashi ji" (The Record of Major Events in Our National Lunar Orbiter Exploration Program) http://news.xinhuanet.com/newscenter/2007-10/24/content_6933859.htm; "Chang'e Tanyue Jihua Shi Zenme Chulu De (the Genesis of the Chang'e Lunar Program)," in *Dangzheng Luntan* (Ganbu Wenzhai) (Party and Government Forum) (2008).

³⁸ Science objectives: obtain three-dimensional image of lunar surface; analysis of lunar surface characteristics; analysis of lunar soil; measurements of the lunar environment. Engineering objectives: develop and launch China's first lunar exploration satellite; develop lunar orbiting technology; develop scientific instruments to take lunar measurements; continue to develop lunar engineering expertise.

³⁹ Xinhua, "Kexue Juece Zhu Hui Huang – Dang Zhong Yang Guanxin Yueqiu Tance Gongcheng Jishi (a Brilliant Scientific Plan – a History of Center-Lunar Exploration Program Relations)," *Xinhuanet.com* December 12, 2007).

³³ The report states: "To develop space science and explore outer space by developing a scientific research and technological experiment satellite group of the next generation, strengthening studies of space micro-gravity, space material science, space life science, space environment and space astronomy, and carrying out pre-study for outer space exploration centering on the exploration of the moon."

³⁴ The report: "Yue qiu tance yi qi gongcheng zonghe lixiang lunzheng baogao".

³⁵ Kenneth Lieberthal, and Michel Oksenberg, *Policy-Making in China: Leaders, Structures and Processes* (Princeton: Princeton University Press, 1988).

Taiwan Affairs and others. These groups are formed by the State Council, the top government organ. The military also creates its own leading groups to coordinate policy, such as the PLA Leading Group on Earthquake Rescue and Relief Work and others.⁴⁰ Such groups are often formed by the Central Military Commission, the military's equivalent to the State Council. In this context, the unusual mix of government and military bureaucracies exhibited by the lunar program would require a hybrid leading small group.

The LSG for the Lunar Orbiter Project was created by the Central Committee of the Communist Party of China and the State Council on 19 February 2004.⁴¹ It is also believed that a "Lunar Probe Project Office" under the Party Central Committee was formed. This office is similar to the "Human Spaceflight Project Office" under the Party Central Committee.⁴² Other space offices under the Committee relate to the five primary budget lines for the national space program: human spaceflight, lunar projects, navigation satellite constellation, high-resolution Earth observation and next-generation carrier rockets.⁴³ The Central Committee is one of the highest organs of power in China and exists just under the Politburo and the supremely important Politburo Standing Committee. Among its 300 or so members are the top leaders of the Party, government and military.⁴⁴ While Premier Wen Jiabao apparently chairs many key central committee meetings, including those associated with major space programs, the Central Committee itself is currently chaired by General Secretary Hu Jintao.

The new LSG was led by COSTIND Director and Central Committee member Zhang Yunchuan, and included leaders from COSTIND, the National Development and Reform Commission, the Ministry of Science and Technology, Ministry of Finance, General Armaments Department of the PLA, Chinese Academy of Sciences and China Aerospace Science and Technology Corporation (CASC).⁴⁵

The leading group nominated key leadership positions within the program: Luan Enjie would be General Commander, Sun Jiadong was named Chief Designer and Ouyang Ziyuan was named Chief Scientist. Chief Designer Sun Jiadong would oversee the overall engineering plan, research and construction.⁴⁶ This "Chang'e Iron Triangle" (*Chang'e tie sanjiao*) formed the core programmatic leadership of the project.

Sun Laiyan (CNSA), Jiang Mianheng (CAS), Wang Wenbao (COSTIND) and Lei Fanpei (CASC) were selected as Deputy Commanders.⁴⁷ Chen Bingzhong, Jiang Jingshan and Long Lehao were named Deputy Engineers.⁴⁸

The ministries represented in the initial LSG indicate that the lunar probe project was an unusually broad effort that spanned several centers of national power. The NDRC and the Ministry of Finance are state organs with supra-ministerial capacity for coordination. These organizations operate at the highest levels and serve to integrate and align the fragmented efforts of multiple ministries. In the pre-reform era, ideology played an important role in aligning efforts. However, to the extent that ideology now plays

a coordinating role, it is limited to the bland pronouncements issued by top leaders to 'strive hard', follow the 'model of scientific development' and 'always remember the pioneering spirit of "two bombs, one satellite"'. While important to creating a sense of shared mission, such appeals to nationalism rarely serve to settle inter-agency disputes or solve budget problems. Supra-ministerial organs and leading small groups are now the most important national coordinating bodies and are centers of cross-ministry negotiation and consultation.

As is common with other major space engineering projects in China, the Leading Small Group established a "two-line command structure"⁴⁹: The Lunar Orbiter Leading Small Group Office led by the General Commander and the COSTIND Lunar Exploration Engineering Center led by the Chief Designer.⁵⁰ These two lines managed the various subsystems of the project, as indicated in Fig. 1. At the very top, and overseeing the two command lines was the Leading Small Group and its Director, Zhang Yunchuan of COSTIND. The only related office superior to this is believed to be the Lunar Probe Project Office of the CPC Central Committee. Zhang Yunchuan was both the chair of the LSG and a member of the CPC Central Committee during the lunar probe project.⁵¹ Note that the position of Chief Scientist does not carry the authority of the Commander or Designer positions.

The program made rapid progress in 2004, completing work on several major subsystems. China's news agency reported that, on 4 February 2005, General Secretary Hu Jintao chaired a Politburo Standing Committee meeting to hear the progress of the lunar exploration project report. Participants regarded the "one satellite, one shot" approach as quite risky and declared that two satellites should be manufactured, so a back-up would exist.⁵² Naturally, given the perceived authority of the General Secretary, this advice was followed to the letter and a duplicate satellite was made.⁵³

The project entered into cooperative partnerships with Europe (ESA) and Russia (Roscosmos) for tracking support, data sharing and other activities. At the end of 2005, the leading group held its third meeting to review progress. In February 2006 Premier Wen Jiabao again inspected the project. In late January 2007, he would also visit the development team to inspect the work.

Anticipating the deluge of international and domestic attention that China's first lunar shot would command, COSTIND set up an additional Leading Small Group on News Propaganda to coordinate the media message in June 2007.⁵⁴ The LSG on News Propaganda Office was located in the COSTIND Propaganda Office. At the time of its inception, the group consisted of the powerful COSTIND Vice Director Chen Qiufa, and lower-level members of PLA-GAD and

⁴⁰ Alice Miller, "The CCP Central Committee's Leading Small Groups," in *China Leadership Monitor* (Palo Alto: Stanford University, 2008).

⁴¹ Ibid.

⁴² Kulacki, "A Place for One's Mat: China's Space Program, 1956–2003."

⁴³ "China's Space Activities in 2006" and interview with Chinese space official.

⁴⁴ Lieberthal, *Governing China: From Revolution through Reform*.

⁴⁵ He, "Chang'e Benyue Zhilu (The Path of Chang'e to the Moon)."

⁴⁶ "Chang'e Tanyue Jihua Shi Zenme Chulu De (the Genesis of the Chang'e Lunar Program)."

⁴⁷ Notes of interest: Jiang Mianheng (Vice President of CAS) is former President Jiang Zemin's son. Wang Wenbao would later assume the role of Director of the China Manned Space Engineering Office in 2007. Additional biographical information: <http://www.chinavita.com/> and <http://baike.baidu.com/>.

⁴⁸ He, "Chang'e Benyue Zhilu (The Path of Chang'e to the Moon)."

⁴⁹ The human spaceflight program *Shenzhou* uses the same structure of authority, according to CMSEO Director General Wang Wenbao in an interview published on the China Manned Space Engineering website: <http://www.cmse.gov.cn/>.

⁵⁰ Raoyue tance gongcheng lingdao xiaozu ban gong shi (Lunar Orbiter Project Leading Small Group Office) and Guofang Kegong Wei Yueqiu Tance Gongcheng Zhongxin (National Defense Working Group Lunar Exploration Engineering Center). Source: <http://www.miit.gov.cn/n11293472/n11293877/n12079125/n12079351/12082808.html>.

⁵¹ China Vitae website: http://www.chinavita.com/biography/Zhang_Yunchuan%7C323.

⁵² Xinhua, "Kexue Juece Zhu Hui Huang – Dang Zhong Yang Guanxin Yueqiu Tance Gongcheng Jishi (a Brilliant Scientific Plan – a History of Center-Lunar Exploration Program Relations)," *Xinhuanet.com* December 12, 2007).

⁵³ According to Chinese lunar officials interviewed for this article, the back-up satellite, *Chang'e 2*, has been outfitted with new instruments and is scheduled to launch in 2011.

⁵⁴ http://english.gov.cn/wszb/zhibo114/content_712268.htm.

Accessed on November 6, 2009.

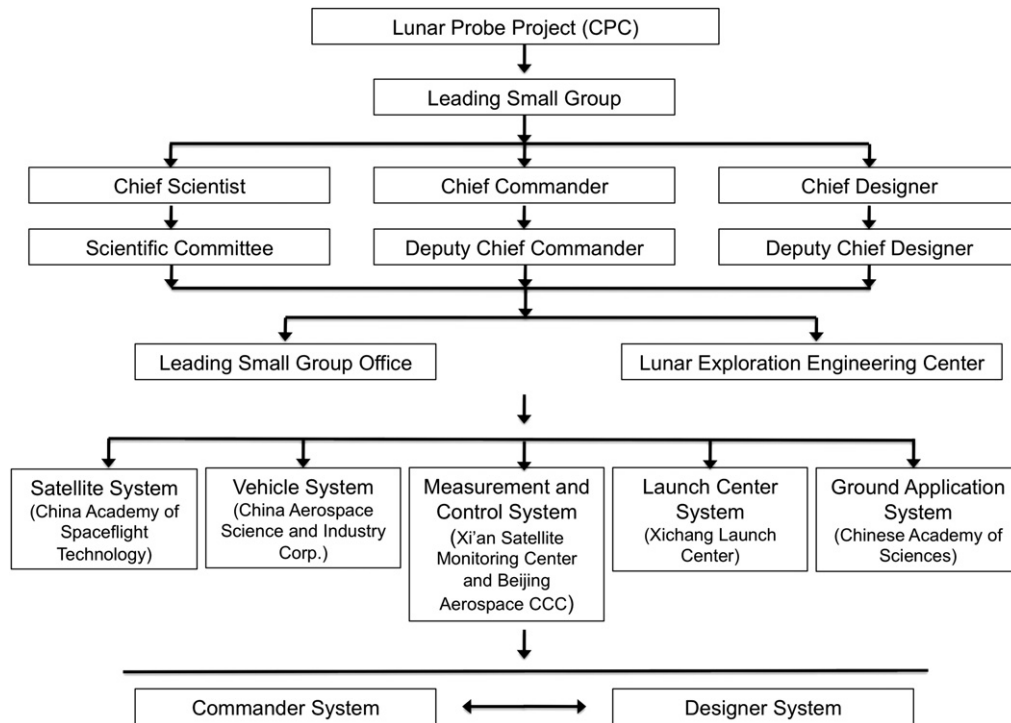


Fig. 1. China's Lunar Program Organization Source: Adapted in part from: Wu Weiren, *Ben Xiang Yue Qiu (To the Moon)* (Beijing: Zhongguo yu hang chu ban she, 2007). Schematic has been translated and expanded with information from other sources.

military departments.⁵⁵ This LSG was a deputy-level group chartered by COSTIND to coordinate on a specific policy subsystem within the larger program.

In October 2007 the LSG arrived at Xichang Satellite Launch Center in Taiyuan, Shanxi Province to review the mission. The group now consisted of a new leader, COSTIND Director Zhang Qingwei, and his deputies COSTIND Deputy Director and Chief Designer Sun Jiaodong, General Armament Department Deputy Minister Zhang Jianqi, *Chang'e* General Commander Luan Enjie and CASC Director Ma Xingrui.⁵⁶

On 24 October 2007 the *Chang'e 1* mission was launched and, just over a week later, China's first lunar satellite entered its orbit around the Moon. Newspapers around the country heralded the success of "China's two-thousand year old dream".

The *Chang'e 1* mission can be regarded as a significant success. While the project experienced numerous setbacks and delays during development, from public appearances, the orbiter performed quite well during operations with only a few minor glitches. The Director of SASTIND and Administrator of CNSA held a news conference in late November 2008 to announce the key results of the mission, which included a complete high-resolution map of the moon, analysis of fundamental lunar surface elements and detailed observations of the space environment. According to the public

data archive plan, data from the mission will be stored at several government centers and universities in China.

7. Conclusion

A careful review and analysis of the *Chang'e* lunar probe project, from policy proposal to policy implementation, reveals insights into the decision and policy-making processes of the Chinese space program.

First, the project was initially proposed and pushed by a small group of scientists at the Chinese Academy of Sciences. The *guanxi* relations between Ouyang Ziyuan and other CAS scientists enabled him to get initial "863" funding and begin drafting studies for consideration. Furthermore, the unique position of and status of CAS enabled them to garner attention at fairly high levels within government. However, this "inside access" was not enough to push a policy onto the agenda. Ouyang Ziyuan, Min Guirong and others submitted several feasibility studies and scientific reports, but all were initially rejected. A second explanation for the initial proposal rejection was that the initial rationale for a lunar probe project was based on political considerations, rather than scientific objectives. The authors were repeatedly instructed to re-submit with a more solid scientific plan.

Second, gaining a real supporter and advocate of the program at a high level of decision-making power was necessary to advance the project. The ascension of Luan Enjie to Deputy Director of COSTIND in 1998 greatly contributed to program success. He was able to advocate the project to top policy makers, who placed it on the agenda. As a result, the project was granted initial pre-study funding and included in a State Council-issued *2000 White Paper on Space Activities*. In this instance, CAS scientists did not initially have much *guanxi* with COSTIND officials. However, they did share the common goal of developing China's first lunar mission. *Guanxi* can often be used as a nebulous catch-all for processes not well understood by

⁵⁵ Chen Qiufa would later become Vice Minister of the Ministry of Industry and Information Technology (MIIT), and also the Director of the newly reorganized State Administration for Science and Technology Industry for National Defense Bureau (SASTIND). In July 2010, he was appointed the new Administrator of China National Space Administration (CNSA), succeeding Sun Laiyan.

⁵⁶ Two years after the mission launched, with the major task of coordination completed, the leading small group met again in Beijing. The membership included SASTIND (formerly COSTIND) Director Chen Qiufa, Minister of Education Chen Xi, GAD Deputy Minister Maj. General Niu Hongguang, CAS President Yin Hejun, Chinese Academy of Engineering Vice President Pan Yunhe and CASC Director Ma Xingrui.

researchers. It is the mysterious force behind the scenes. While it undoubtedly plays a key role in policy making, its importance should not be overestimated. Similarly, the highly personalistic style that characterizes some decision making in the government is often in tension with the formal bureaucracy, which seeks to remove personal discretion by bolstering the power of office, position and process. In the lunar program example, this tension is readily apparent, with some decisions the result of personal connections and others of bureaucratic process.

Third, getting the project on the agenda involved both the support of an influential supporter and the complex inter-agency process of bargaining and consensus making. The consideration and re-consideration of feasibility studies by the NDRC and State Council is a way to build group consensus regarding a policy. Not only did the core group of CAS supporters and authors grow each year a proposal was submitted, but the policy makers in central government changed, enabling more people to become familiar with the policy idea. The process also forced the authors to continually refine their plans, moving away from political rationales and toward scientific rationales. To create the final, accepted feasibility studies COSTIND coordinated hundreds of representatives' inputs from dozens of organizations across the nation. Only once the report was approved, could the State Council and others approve initial funding for the project.

Fourth, the implementation of the lunar probe project was a vast undertaking coordinated at the highest levels of government. Because of the fragmented authoritarian nature of power, the participation of the CPC Central Committee in key decisions was necessary because the equally powerful policy-making organs of the government and military were involved. Several reports indicate that Premier Wen Jiabao made key program decisions and President Hu Jintao approved some decisions as well (such as the creation of a second back-up satellite).

Fifth, an assiduously incrementalist approach to policy making was revealed. Major decisions were carefully reviewed by numerous organizations before initial approval was given. Initial approval was often simply an instruction to conduct a pre-study feasibility report, to be completed before the next stage of approvals could be granted. Policy making is slow, methodical, highly rational and incrementalist.

Finally, membership in the LSG is not dependent upon personality, but upon position and organization. Throughout the project's lifetime, the head of the LSG has always been the Director of COSTIND (in 2003 COSTIND was restructured to become the State Administration for Science and Technology Industries for National Defense (SASTIND)).⁵⁷ Other positions have been filled as members have retired or taken up new jobs elsewhere. Some positions on the LSG have been eliminated as the function of the LSG changed (e.g., once the project completed the budgeting phase and major engineering phases, it appears that NDRC and Ministry of Finance left the group). This reveals a rigidly hierarchical and impersonal bureaucracy, much like the Max Weber's ideal bureaucracy. Weber insisted that duties in the bureaucracy were the function of an

office or position, and not the individual. In the Chinese context, this is significantly different from previous eras in which the personality of the office holder was of fundamental importance.

The use of policy-making frameworks and models such as "fragmented authoritarianism" and the "inside access model" is helpful. The fragmented authoritarian nature of power in China explains the endless sessions of consensus building and incrementalism that exist in the policy-making system. This theory also explains the utility and need for leading small groups, which are able to coordinate across bureaucratic organs more likely to fight with each other over scarce resources than cooperate together on a national project. The inside access model is a much more sharply limited and defined model of agenda-setting. With regard to the lunar probe project, elite government scientists and policy entrepreneurs proposed and pushed the project onto the agenda. Clearly, this model describes a key agenda-setting process in contemporary China.

This study represents an early, detailed examination of the Chinese lunar probe project written in English and based on original Chinese sources. The mission only recently ended in March 2009, so the first draft of history has only just been sketched.⁵⁸ While this case study hopefully illuminates some of the rigorous push-and-pull between elite policy entrepreneurs and top decision makers, much more study is necessary in order to expand this model. Additional studies, especially with the cooperation of Chinese space experts, can begin to open up the "black box" of policy making in China's space program. The human spaceflight program is considerably more opaque but my research leads me to believe that there are a large number of similarities between policy making in the two programs. For example, they share many of the same leadership personnel, with the exception that the highest levels of human spaceflight program leadership command greater authority and are more closely affiliated with the Central Military Commission and the General Armaments Department of the PLA.

Insight into China's space program could serve a number of purposes, and perhaps the most important would be a better understanding of how the nation operates and implements major projects. This may yield two results. First, it provides information about China's space strategy and its position and relationship to the country's development and modernization strategy. Understanding that important parts of China's space program are guided by highly rational, incrementalist policies that are concurred upon at the highest levels of government allows analysts to discern the policy-making processes and, potentially, the intentions of top leaders. Second, such insight can help to guide cooperation between the two nations. Transparency is one of the most important conditions that must be achieved before two countries can meaningfully cooperate on high-risk and large-scale projects. Indeed, before China can more fully cooperate with the U.S. space program on endeavors such as the International Space Station, civil space officials believe three essential principles must be demonstrated: transparency, reciprocity and mutual benefit.

⁵⁷ COSTIND was downgraded to a bureau, the State Administration for Science and Technology for National Defense Bureau (SASTIND), as a result of NPC legislation on 18 March 2008.

⁵⁸ The *Chang'e* mission was terminated with a planned crash into the lunar surface on 1 March 2009.